

## Clinical Practice

*This Journal feature begins with a case vignette highlighting a common clinical problem. Evidence supporting various strategies is then presented, followed by a review of formal guidelines, when they exist. The article ends with the author's clinical recommendations.*

## HEAD LICE

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An eight-year-old girl is sent home after the school nurse detects head lice. She will not be permitted to return to school until the absence of infestation is documented. What treatment strategy is most likely to allow her to return to school with a minimal risk of infecting her classmates?

## THE CLINICAL PROBLEM

## Head-Lice Hysteria

Although *Pediculus capitis*, or head lice, are harmless, concern about them often elicits a disproportionate response that may cause substantial harm. It is estimated that children in the United States lost 12 million to 24 million days of school in 1998 because of "no-nit" policies, which exclude children who have any nits (egg cases) on inspection.<sup>1</sup>

## Nature of Infection

Infestation with head lice is common, is endemic worldwide, and affects persons of all ages and socioeconomic backgrounds. It is more common between the ages of 5 and 11 years and in girls, and it is rare in blacks.<sup>2</sup> The prevalence is typically 1 to 3 percent in industrialized countries but may on occasion exceed 25 percent in elementary schools. The prevalence is probably increasing in the United States.<sup>3</sup> Infestation is usually symptomless and is not associated with serious disease. The head louse effectively infests only the human head and is distinct from body and pubic lice. It feeds by sucking blood, simultaneously injecting saliva, which sometimes causes itching of the scalp and, in neglected cases, secondary infection and general malaise.<sup>4,5</sup>

After mating, an adult female louse lays one to six eggs a day for up to one month until death (Fig. 1).<sup>6</sup> The eggs are initially translucent and attached to a hair shaft close to the scalp. After hatching in seven days, the 1-mm-long empty egg cases (nits) become white and more visible. After 9 to 12 days and three molts, the grayish or dark louse becomes an adult the size of a sesame seed (3 to 4 mm long) (Fig. 2). Most infestations consist of fewer than 10 lice, mostly small nymphs 1 to 2 mm long.<sup>8</sup> Nits remain firmly attached to the hair shaft, moving away from the scalp as the hair grows. The distance from the scalp is a measure of age (with 1 cm indicating one month).

## Transmission

The spread of lice probably occurs mainly through direct head-to-head contact and is common within households.<sup>9</sup> It is also stated to occur through the sharing of combs, hairbrushes, or hats, particularly in the U.S. literature,<sup>10,11</sup> but supporting evidence is lacking. Adult lice can survive up to 55 hours without a host<sup>6,12</sup> but probably become nonviable because of dehydration long before death. Lice cannot jump or fly. Pets are not vectors.

## STRATEGIES AND EVIDENCE

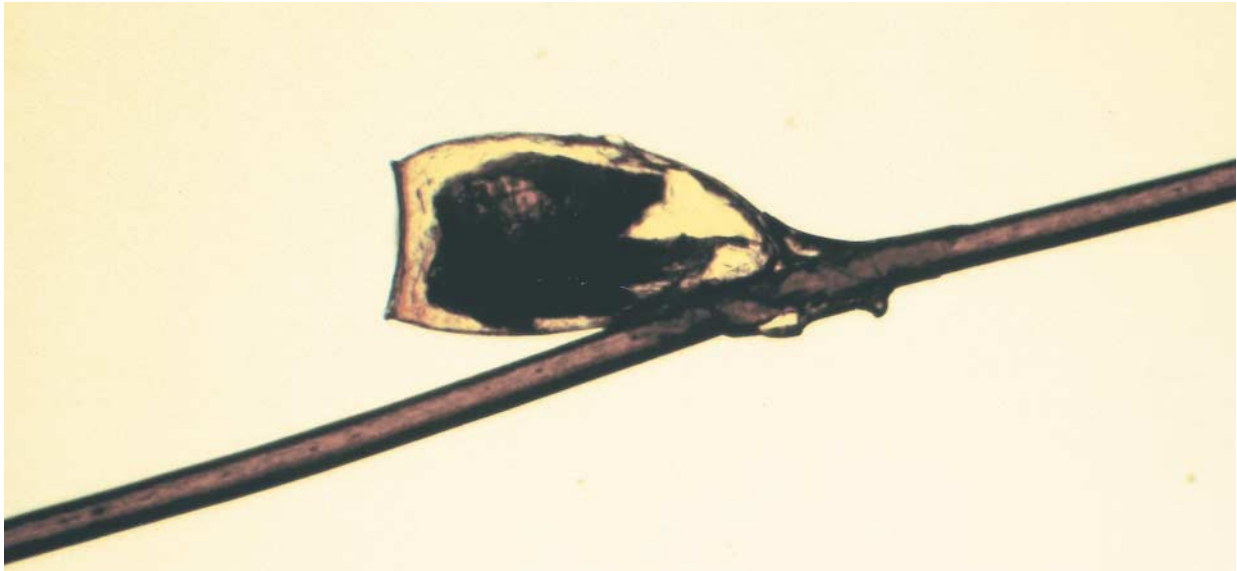
## Diagnosis

The condition is frequently misdiagnosed.<sup>13</sup> Finding nits does not indicate active infestation, since nits may persist for months after successful treatment. According to the Centers for Disease Control and Prevention (CDC), diagnosis can be based on finding "many eggs within a quarter inch [6.5 mm] of the scalp,"<sup>2</sup> but these do not result in louse infestation in over two thirds of cases,<sup>14</sup> and other authorities suggest that diagnosis should be based only on finding a living, moving louse.<sup>15</sup>

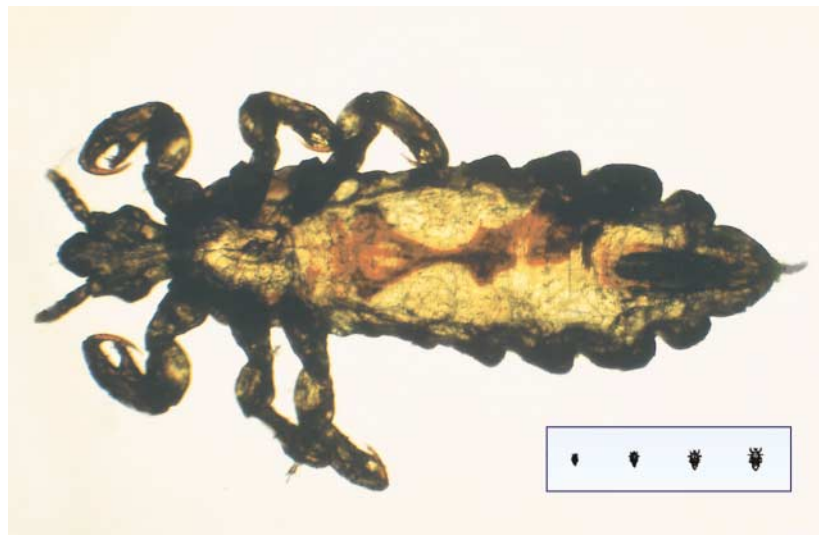
Visual inspection of the hair and scalp is widely practiced, but this approach may miss three quarters of infestations detectable by combing hair with a fine-toothed "nit," or detection, comb; this type of comb was also twice as fast as visual inspection in detecting live lice in one study.<sup>8</sup> Combing wet hair has also been advocated<sup>16</sup> and may be more sensitive than combing dry hair. Although this approach is too impractical for routine clinical use,<sup>17</sup> it may facilitate diagnosis in people with long, thick hair.

After the hair is combed or brushed to remove tangles, the fine-toothed comb should be inserted near the crown until it gently touches the scalp, and then

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**Figure 1.** An Unhatched Nit (Egg Case) of the Head Louse, *Pediculus capitis* ( $\times 100$ ).



**Figure 2.** The Head Louse, *Pediculus capitis* ( $\times 100$ ).

The inset shows actual sizes in the stages of growth of the head louse (first-stage, second-stage, and third-stage instar nymphs and adult).<sup>7</sup>

it should be drawn firmly down. The teeth of the comb should be 0.2 to 0.3 mm apart to trap lice. The entire head of hair should be combed systematically at least twice; the comb should be examined for lice after each stroke. It usually takes approximately one minute to find the first louse.<sup>8</sup>

#### Treatment

There are three basic treatment options for head lice for which there is some scientific evidence of efficacy: topical insecticides, wet combing, and oral therapy. Many natural and synthetic chemicals have been tested in vitro against lice raised in the laboratory or

harvested from patients. However, although in vitro tests are useful for comparative study, the results are not representative of the effectiveness of treatments when used by consumers. Effective insecticides kill both lice and eggs.

Topical insecticides have been extensively studied, although many of the studies have had methodologic limitations. Of 71 clinical trials of insecticides,<sup>18</sup> only 4 met the criteria for quality of the Cochrane reviewers, including the presence of live lice at diagnosis, no use of insecticide in the previous two to four weeks, and no adjunctive use of nit-removal combs. Data from these trials demonstrated cure rates of more than 95 percent with each of the topical insecticides used most commonly in the United States — permethrin,<sup>19</sup> synergized pyrethrin,<sup>20</sup> and malathion.<sup>21</sup> These results, however, reflected application of these drugs by researchers to fully susceptible populations, and the emergence of drug resistance means that the results may not reflect the current effectiveness of the insecticides. In a more recent study, malathion resulted in a cure rate of 78 percent in a partly resistant population in the United Kingdom when applied to children's scalps by their parents.<sup>22</sup> Malathion is an organophosphate, and exposure to agricultural organophosphates can have neurologic effects, but studies of malathion in humans show no evidence of toxicity.<sup>23,24</sup> Alcoholic preparations of malathion, such as Ovide (Medicis), are flammable until dry.<sup>25</sup> Malathion is only available by prescription in the United States but is available over the counter in the United Kingdom, as are pyrethroids in both the United States and the United Kingdom.

Because of resistance, especially of eggs, authorities in the United States recommend two applications performed seven days apart for permethrin<sup>2</sup> but not for malathion. More than three applications of the same product within two weeks are not recommended. If over-the-counter products containing pyrethroids do not work, neither will prescription-strength (5 percent) permethrin.<sup>2</sup> Shampoos applied to wet hair and powders are not recommended because of the dilution, the short contact time, and the poor penetration of the active ingredient into lice.<sup>19,26</sup> In the United States, most therapeutic shampoos or cream rinses come with a recommendation to apply to dry hair to maximize effectiveness.

Other medications used less commonly may have more serious potential side effects. Lindane, available by prescription in the United States as a 1 percent shampoo, is neurotoxic in rats, with rare reports of seizures, irritability, and nervousness after therapeutic use in humans.<sup>21</sup> Carbaril, which is not available in the United States, was made available by prescription only in the United Kingdom after an increased incidence of tumors was noted in mice exposed to the

product, although the clinical significance of this finding has been disputed.<sup>27</sup> Aerosols, sold for environmental decontamination, can cause severe bronchoconstriction and should never be used on the head.

A recent trial showed that the addition of oral trimethoprim-sulfamethoxazole only marginally increased the cure rate of permethrin creme rinse (from 80 percent to 95 percent).<sup>28</sup> Oral and topical ivermectin has been reported to be effective for head lice. However, neither treatment is licensed for this purpose. The use of systemic treatments for head lice is only justified in severe infestation when effective topical treatments are not available.

Mechanical removal of lice with the use of wet combing by parents is an alternative to insecticides, which are not recommended for children two years of age and younger.<sup>2</sup> The rationale behind wet combing is the fact that lice do not move to another host within 7 days after hatching and do not reproduce within 10 days, and all eggs hatch in about a week; therefore, if all young lice are combed out within a few days after hatching, the infestation can be eradicated. The combing procedure is the same as for diagnosis but is done on wet hair with added lubricant (hair conditioner, which may irritate, or olive oil) and continued until no lice are found (15 to 30 minutes per session or longer for long, thick hair). Combing is repeated once every three to four days for several weeks and should continue for two weeks after any session in which an adult louse is found. This approach cured 38 percent of children in a trial in which treatment was carried out by parents, but it was only half as effective as malathion lotion.<sup>22</sup>

## AREAS OF UNCERTAINTY

### How Effective Are Insecticides in Normal Use in Partly Resistant Populations?

The emergence of resistance to commonly used insecticides has long been recognized,<sup>29</sup> and the results of efficacy studies in populations in developing countries cannot be directly applied to industrialized countries.<sup>30</sup> High levels of resistance to pyrethrins and the synthetic pyrethroids permethrin and phenothrin, including cross-resistance,<sup>31</sup> have been widely reported since the mid-1990s in the United Kingdom, France, Israel, Czech Republic, and Argentina,<sup>32-35</sup> as has clinically significant resistance in the United States, with head lice from "problem infestations" completely unaffected by permethrin in vitro.<sup>3,36</sup> Resistance to malathion, alone and in conjunction with pyrethroids, has been reported, but despite varying effectiveness in the United Kingdom (36 to 78 percent), malathion remains clinically helpful.<sup>22,26,37</sup> There is currently no published evidence of clinically significant resistance to carbaril. No systematic data on the distribution of resistance are collected in the United States. New tech-

niques for identifying resistance have the potential to allow authorities to specify effective treatments for a specific geographic area.<sup>31</sup>

#### Is Exclusion from School Necessary?

Transmission certainly occurs between pupils at school,<sup>38</sup> and exclusion from school for head lice is an almost universal practice in the United States.<sup>1</sup> However, the lice have probably been present for weeks before detection, and a few extra hours will make no significant difference to the risk of transmission. Three quarters of children with nits alone are not infested, and no-nit policies are therefore excessive.<sup>14</sup> Exclusion from school based on the presence of lice or nits is not recommended by the American Public Health Association.<sup>11</sup>

#### What Is the Role of Alternative Therapies or Environmental Decontamination?

There are no published trials assessing the safety or efficacy of “herbal” chemical treatments, “natural” oils, or home remedies (e.g., petrolatum, mayonnaise, or kerosene) or electrocution by battery-powered combs. Data are lacking to assess whether disinfection of personal or household items affects the likelihood of cure or the recurrence of lice.

### GUIDELINES

Guidelines for the detection and management of head lice have been issued by the CDC,<sup>2</sup> the American Public Health Association,<sup>11</sup> the Canadian Paediatric Society,<sup>39</sup> and the United Kingdom Department of Health.<sup>40</sup> Both U.S. guidelines recommend a range of topical insecticides (the CDC implies that

malathion is the most effective) and do not refer to wet combing. The Canadian guidelines state that diagnosis can be based on “lice and/or nits” and also recommend the use of any of several topical insecticides. The United Kingdom Department of Health advocates the use of a detection comb on wet hair for diagnosis and treatment only if live lice are found; it recommends either topical insecticides or wet combing for treatment.

Opinion is sharply divided on the need for disinfecting personal and household items. The CDC advises<sup>2</sup> that anything touched by the patient in the previous two days should be (in order of preference) hot washed, dry cleaned, sealed in plastic for two weeks, or vacuumed, whereas authorities in the United Kingdom advise against environmental cleaning. Use of insecticide sprays to disinfect furnishings is not recommended.<sup>2</sup>

Several organizations also have fact sheets for public information. Particularly useful information is available from the CDC at <http://www.cdc.gov/ncidod/dpd/parasites/lice/default.htm>.<sup>2</sup>

### CONCLUSIONS AND RECOMMENDATIONS

With regard to the case vignette, the eight-year-old and her parents should be informed that head lice are harmless pests that like clean hair and that most children get them at some point, including doctors' children. The term “infection” may be preferable to “infestation.” Parents should be provided with good written information (such as the CDC fact sheet).<sup>2</sup>

Ideally, diagnosis should be based on the presence of a living, moving louse and is best made with the use of a fine-toothed detection comb. I prefer plastic

TABLE 1. TREATMENTS FOR HEAD LICE.

NAME	AVAILABILITY IN THE UNITED STATES	SAFETY PROFILE	ESTIMATED EFFECTIVENESS IN PRACTICE*	CONTRAINDICATIONS
Malathion	Prescription only (Ovide)	Intermediate†	Good	Insecticides are not recommended for children two years of age or younger
Pyrethroids (permethrin) and pyrethrins	Over the counter (A200, Nix, Pronto, R&C, RID, Triple X)	Good	Intermediate‡	Alcoholic formulations (e.g., Ovide) should not be used in patients with asthma or severe eczema or in young children
Wet combing	—	Good	Poor	
Lindane	Prescription only	Poor	Poor	

\*Estimates are based on good evidence of efficacy from randomized controlled trials, expert opinion, and the estimated probability of resistance in the United States.

†Alcoholic vehicles are flammable until dry. The safety profile for aqueous vehicles is good (these are not available in the United States).

‡Two applications, performed one week apart, are recommended.

combs to steel, because they are easier to use and no less effective. If all nits are found more than a quarter of an inch from the scalp, no treatment is indicated. Diagnosis can be based on nits within a quarter of an inch from the scalp but will result in unnecessary treatment in 7 of 10 children.<sup>14</sup> If infestation is confirmed, malathion is currently more likely to be effective than permethrin and pyrethrins in the United States, although the latter are acceptable alternatives (Table 1). If infestation recurs within one month after treatment, a different topical insecticide should be used. Alcoholic malathion lotion has a strong smell and takes a long time to apply, and although it is widely used in the United Kingdom, its use has not yet become commonly accepted in the United States.

Sufficient treatment should be applied to wet the entire scalp, though it need not be applied to the ends of long hair below the level of the shirt collar. Hair should be washed with regular shampoo to remove the insecticide at the end of the recommended application period. If permethrin or pyrethrins are used, two applications performed one week apart are recommended.

For children two years of age and younger, or if parents prefer not to use an insecticide, wet combing is an alternative, although it is less effective.<sup>41</sup> Some parents may prefer to use "natural" herbal products but should be educated that "natural" does not necessarily mean safe. Head shaving is only briefly effective and is too traumatic for children. Nits are difficult to remove; there is no evidence that over-the-counter "nit looseners" or "nit removers" weaken the attachment to the hair. Applying hair conditioner and then gripping the hair with the index finger and thumb and sliding the nits off is as good a method of removal as any.

Household members and those in close contact with the patient should be screened for head lice and treated as necessary. Environmental cleaning is probably unwarranted, although combs and brushes should be washed in hot water (60°C).

A fine-toothed comb should be used a day or two after the final application of insecticide to confirm that the treatment has been successful. The presence of live (moving) lice of all sizes suggests resistance to treatment, whereas finding only one adult-sized louse suggests reinfestation. Regular weekly detection combing is recommended for several weeks after cure.

A child can return to school immediately after completion of the first application of a normally effective insecticide or the first wet combing session, regardless of the presence of nits. It would be useful to provide a letter of explanation to the school nurse.

In 1998, half the school nurses in the United States would not allow a child with nits back into school.<sup>1</sup> Excluding children from school because of head lice

results in anxiety, fear, social stigma, overtreatment, loss of education, and economic loss if parents miss work — a classic case of the cure being worse than the disease. Management should not harm the patient more than the pest.

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